Week 11 – Ch 18 – Open-Economy Macroeconomics (Part 1)

Outline

- Introduce the **balance of payments accounts** and the **balance of payments identity**.
- Use the **market for loanable funds** to model the **international flows of funds**.
- Use the **demand-supply model** to determine the **exchange rate**.

Capital Flows and the Balance of Payments

Balance of Payments Accounts

- A country's **balance of payments (BOP)** accounts record a country's ***international transactions*** with the rest of the world (ROW).

⇒ The **BOP accounts** include the international sales (exports) and purchases (imports) of **goods**, **services**, and **assets**.

⇒ It records payments from foreigners (that arise from exports) and payments to foreigners (that arise from imports).

Balance of payments account

Movement of Goods & services

Current Account (CA)

Financial Account (FA)

Movement of Assets

Current Account (CA)

- The **current account** records the **net international flows of goods and services**, and **net factor income** plus **net international transfer payments**.

CA	=	Net exports of goods	NX
	+	Net exports of services	
	+	Net factor income	
	+	Net international transfer payments	
	=	**Current account balance**	

Financial Account (FA)

- The **financial account** records the **sales (exports) of (financial & real) assets** to foreigners and the **purchases (imports) of assets** from foreigners.

⇒It records the ***international flows of financial capital*** – the receipts from and the payments to foreigners arising from the exports and imports of (financial) assets, respectively.

⇒It also includes international transactions carried by the by ***the private sector (households and firms) and the central bank***. Foreign assets held by the central bank are called ***official reserves***.

Financial Account (FA)

- When we ***sell (export)*** assets to foreigners, we will experience ***capital inflows*** as financial capital is flowing **into** the country (i.e., **we are borrowing in net** from the ROW).
- When we ***buy (import)*** assets from foreigners, we will experience ***capital outflows*** as financial capital is flowing **out of** the country (i.e., **we are lending in net** to the ROW).

FA = Exports of assets – Imports of assets

= Capital inflows – Capital outflows

= Net capital inflows

The Balance of Payments Identity

- When taking all international transactions into consideration, the sum of current account and financial account must equal to zero, i.e.,

  CA + FA = 0 [1]

  CA = – FA

  CA = – Net capital inflows = NFI = Net Foreign Investment

If CA > 0, called a CA surplus, then FA < 0, called a FA deficit, we are lending in net to the ROW

[1] In reality, due to missed international transactions, the BOP identity is given by**: CA + FA + statistical discrepancy = 0**.

Modelling the Financial Account

- The financial account records the net sales (net exports) of assets to foreigners.

⇒ To understand the financial account, we need to consider the flows of capital across national borders.

- Use the **loanable funds market** to analyze the **international flows of funds**.

Assumptions

- It is a **two-country world** – Home (H) and Foreign (F).
- All the international capital flows are in the form of **loans**.
- Ignore the effects of the expected change in exchange rate on capital flows.
- There is **perfect capital mobility** and there is **no risk premium**.
- **Net exports (NX) = Net Foreign Investment (NFI)** = Net (outward) flow of loans (Ch 10)

Implications

- Equilibrium in the loanable funds market requires:

⇒ Sum of all countries' **net exports** must equal to **zero**. $NX_H + NX_F = 0$

⇒ Sum of all countries' **international flows of capital** must equal to **zero**. $NFI_H + NFI_F = 0$

⇒ **Domestic interest (i_H) = Foreign interest (i_F) = world interest (i_W).**

- For an open economy, the loanable funds market is characterized as follows:

⇒ **(Domestic) Supply of loanable funds (SF)** comes from **national savings**,

i.e., $SF = S_{National} = S_{Private} + S_{Public}$.

⇒ **Demand for loanable funds (DF)** comes from **domestic investment**, i.e., $DF = I(i)$.

Implications

- Goods Market Equilibrium implies $Y = C + I + G + NX$

$\Rightarrow$ We know $S_{National} = Y - C - G$

$\Rightarrow$ Therefore, we know that following equation must hold in goods market equilibrium

$$Y - C - G = I + NX$$

$$S_{National} = I + NX$$

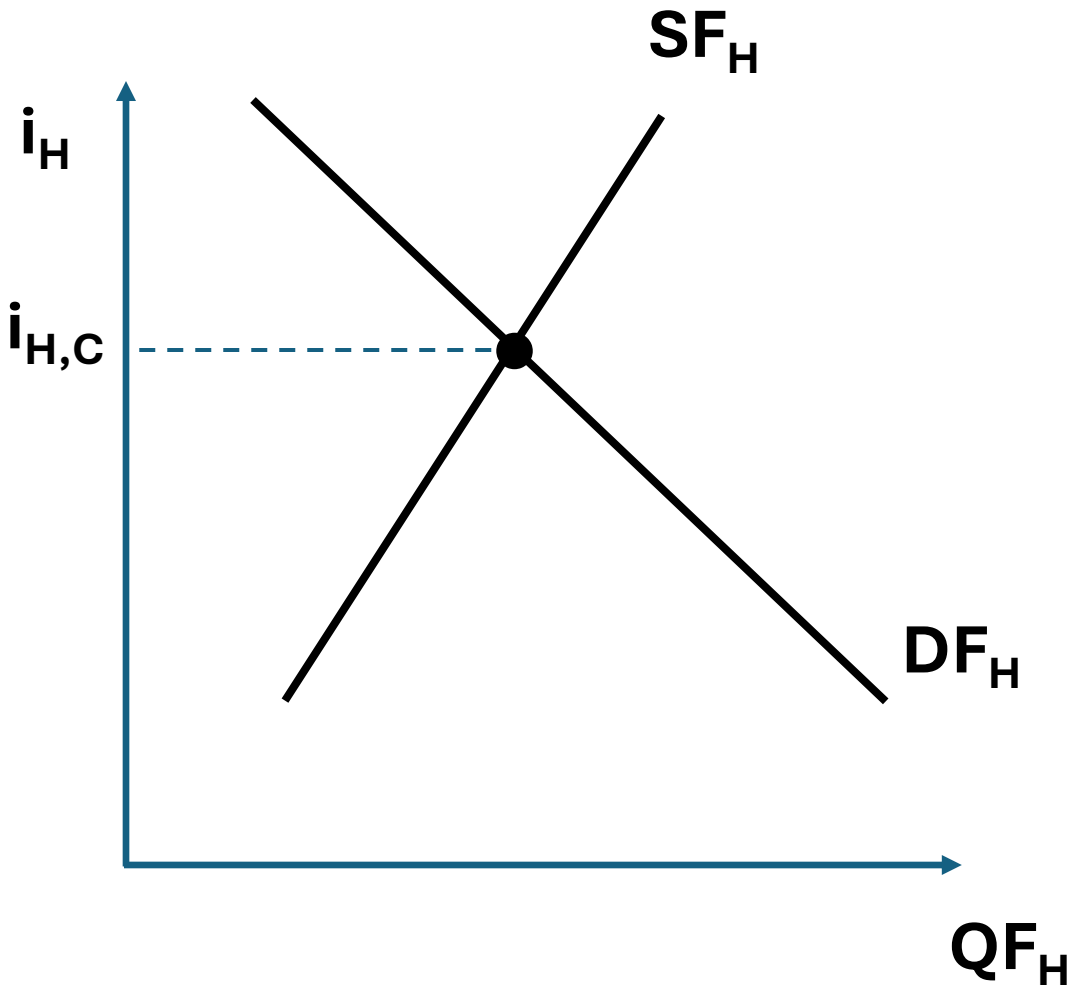
$$S_{National} = I + NFI \qquad \text{(as NX = NFI)}$$

$$S_{National} - NFI = I \qquad \text{(Loanable funds market equilibrium)}$$

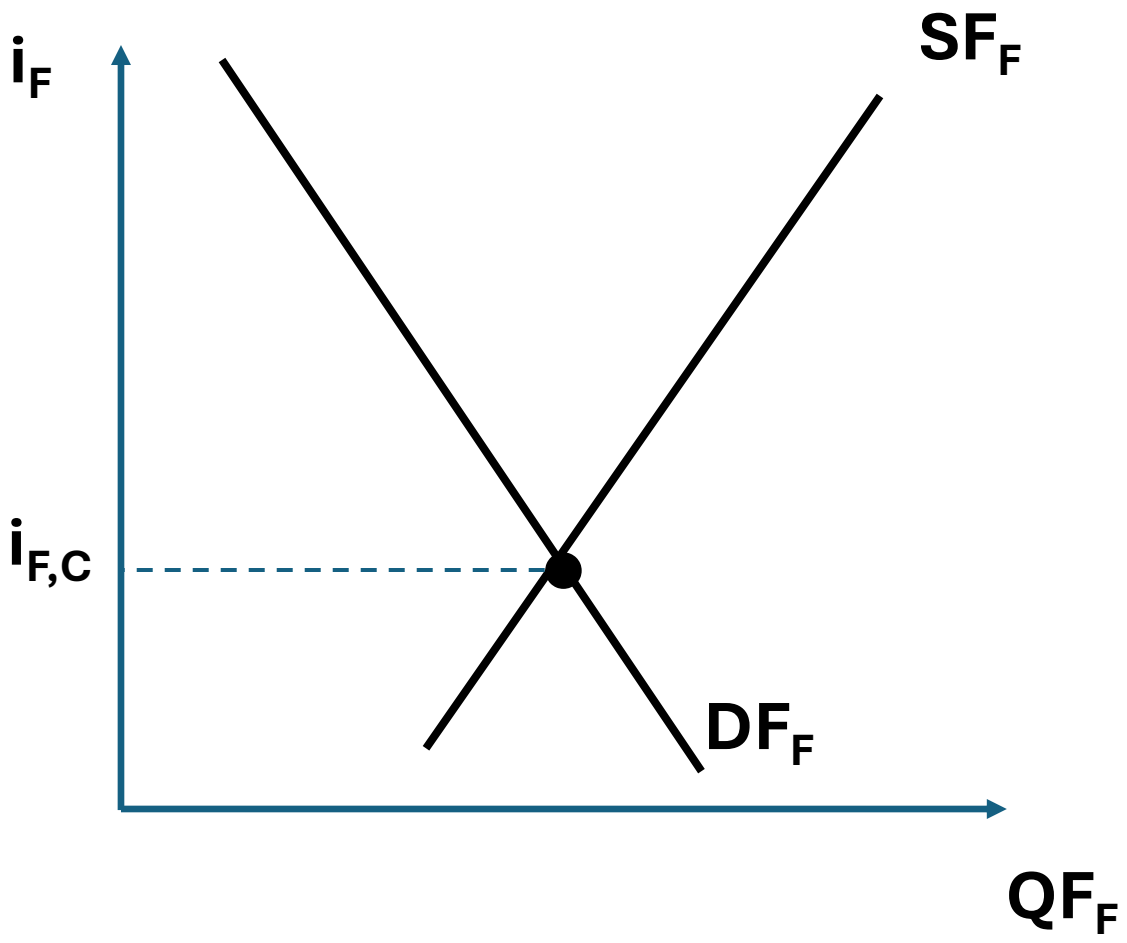
Supply of loans (in Home) = Demand for loans (in Home)

$\Rightarrow S_{National} = I + NFI \Rightarrow NFI = S_{National} - I = -$ Net Capital inflows = Net amount of loans leaving home to ROW

Home



Foreign



Example: Initially $\mathbf{i_{H,C} > i_{F,C}}$, investors find Home's assets are more attractive.

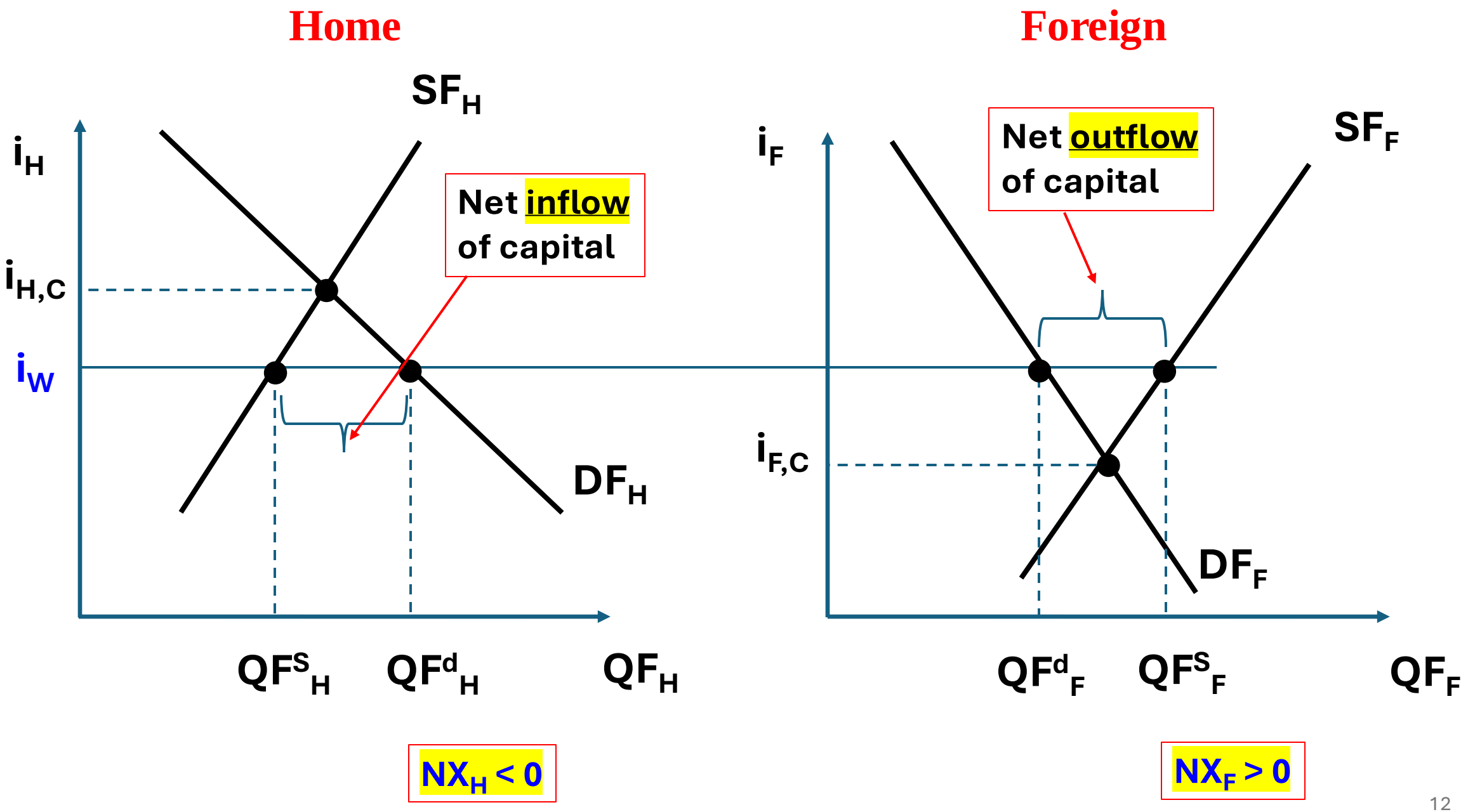
- Home will export assets to Foreign ⇒ Home experiences ***capital inflows***.
- When Home experiences capital inflows

➢ The quantity of funds available in Home ↑ → ↓ $\mathbf{i_H}$

➢ The quantity of funds available in Foreign ↓ → ↑ $\mathbf{i_F}$

➢ This process continues until $\mathbf{i_H = i_F = i_W}$

➢ At $\mathbf{i = i_W}$, capital **inflows** in Home (in net) = capital **outflows** in Foreign (in net)


Home
Foreign
SF_H
i_H
$i_{H,C}$
i_W
Net inflow of capital
DF_H
QF^S_H
QF^d_H
QF_H
$NX_H < 0$
i_F
SF_F
Net outflow of capital
$i_{F,C}$
DF_F
QF^d_F
QF^S_F
QF_F
$NX_F > 0$

The basic math of the BOP

In equilibrium, $\mathbf{CA_H + FA_H = 0}$

$\mathbf{CA_F + FA_F = 0}$

If $CA_H = NX_H =$ + \$ 10 billion

Then, $CA_F = NX_F =$ - \$ 10 billion

So that, $\mathbf{NX_H + NX_F = 0}$

One country's trade surplus is the other country's trade deficit.

Y = C + I + G + NX National Income Identity (Goods Market Equilibrium)

NX = Net Exports = Exports – Imports = X – IM

Y – C – G = NX + I

$\mathbf{S_{National} = NX + I}$

$\mathbf{NX = S_{National} - I}$

NX = SF – DF = (Domestic Supply of funds) – (Domestic Demand for funds)

Suppose $\mathbf{S_{National} = I}$**,** then we know that **NX = 0** **(Balanced Trade** in net**)**

The country is not borrowing or lending (in net) with the ROW

$Y = C + I + G + NX$ National Income Identity (Goods Market Equilibrium)

$S_{National} = NX + I$

$NX = S_{National} - I$

$NX = SF - DF$ = (Domestic Supply of funds) – (Domestic Demand for funds)

Suppose **$S_{National} > I$,** then we know that **$NX > 0$** **(Trade Surplus** in net**)**

The country is lending (in net) to the ROW

$CA + FA = 0 \rightarrow NX + FA = 0 \rightarrow$ **$FA < 0$** **Financial capital is flowing out (in net)**

Suppose **$S_{National} < I$,** then we know that **$NX < 0$** **(Trade Deficit** in net**)**

The country is borrowing (in net) from the ROW

$CA + FA = 0 \rightarrow NX + FA = 0 \rightarrow$ **$FA > 0$** **Financial capital is flowing in (in net)**

Underlying Determinants of International Capital Flows

- The initial interest rate differential between Home and Foreign triggers the international capital flows.
- The interest rate differential can be caused by:

⇒ The **differences in investment opportunities** across countries.

⇒ The **international differences in savings** across counties.

Numerical Example

The world consists of two countries, Home and Foreign. The market for loanable funds in both countries can be described by the following equations:

	Home	Foreign
Demand for loanable funds	$DF_H = 25 - 4i_H$	$DF_F = 26 - 10i_F$
Supply of loanable funds	$SF_H = 20 + 16i_H$	$SF_F = 15 + 10i_F$

- If the countries do not trade with each other, find the equilibrium level of interest rates in both countries.

Home $\mathbf{SF_H = DF_H}$

$20 + 16i_H = 25 - 4i_H$

$20i_H = 5$

$\mathbf{i_H} = (5/20) = \mathbf{0.25\ (25\%)}$

Foreign $\mathbf{SF_F = DF_F}$

$15 + 10\ i_F = 26 - 10i_F$

$20i_F = 11$

$\mathbf{i_F} = (11/20) = \mathbf{0.55\ (55\%)}$

Note: Since $\mathbf{i_F > i_H}$, we expect capital to flow from **Home to Foreign** when trade is opened up.

- Now, suppose **international flows of capital are allowed**. Find the world interest rate and the levels of net foreign investment in both countries.

$\mathbf{NFI_H = SF_H - DF_H}$

$= (20 + 16i_H) - (25 - 4i_H) = \mathbf{20i_H - 5}$

$\mathbf{NFI_F = SF_F - DF_F}$

$= (15 + 10i_F) - (26 - 10i_F) = \mathbf{20i_F - 11}$

Equilibrium: $\mathbf{NFI_H + NFI_F = 0}$ **&** $\mathbf{i_H = i_F = i_W}$

$(20i_H - 5) + (20i_F - 11) = 0$

$40i_W = 16$ $\quad\quad$ $\mathbf{i_W} = (16/40) \mathbf{= 0.4\ (40\%)}$

We derived $\mathbf{i_W}$ = (16/40) **= 0.4 (40%)**

$NFI_H = SF_H - DF_H = 20i_H - 5$ = 20(0.40) – 5 **= 3**

In equilibrium Home <u>exports</u> assets (in net)

$NFI_H = NX_H > 0$ Trade Surplus

Financial capital <u>outflows</u> (from Home to foreign)

Home is <u>lending to</u> foreign (in net)

$NFI_F = SF_F - DF_F = 20i_F - 11 = 20(0.40) - 11 = -3$ (Financial capital <u>inflows</u>)

The Role of Exchange Rate

- A country's **BOP accounts** record the country's international transactions with the rest of the world; it also gives us *the **sources** **of demand for** and **supply of** a country's currency in the **foreign exchange market***.
- A simple **demand-supply model** can be used to discuss the determination of the exchange rate in the **foreign exchange market**.

Understanding Exchange Rate

- **Exchange rate** (**E**) is the relative price of one currency in terms of another currency.
- In our class, **the exchange rate is quoted as the number of foreign currency (FC) units needed to exchange for (buy) one unit of domestic currency (DC);** i.e., $\mathbf{E_{FC/DC}}$.
- E is determined in the foreign exchange market, mainly an over-the-counter market.

Understanding Exchange Rate

- When $\mathbf{E_{FC/DC}} \uparrow$, this means more FC are needed to exchange one unit of DC

  $\Rightarrow$ **DC** ***appreciates (in nominal terms)***

- When $\mathbf{E_{FC/DC}} \downarrow$, this means fewer FC are needed to exchange one unit of DC

  $\Rightarrow$ **DC** ***depreciates (in nominal terms)***.

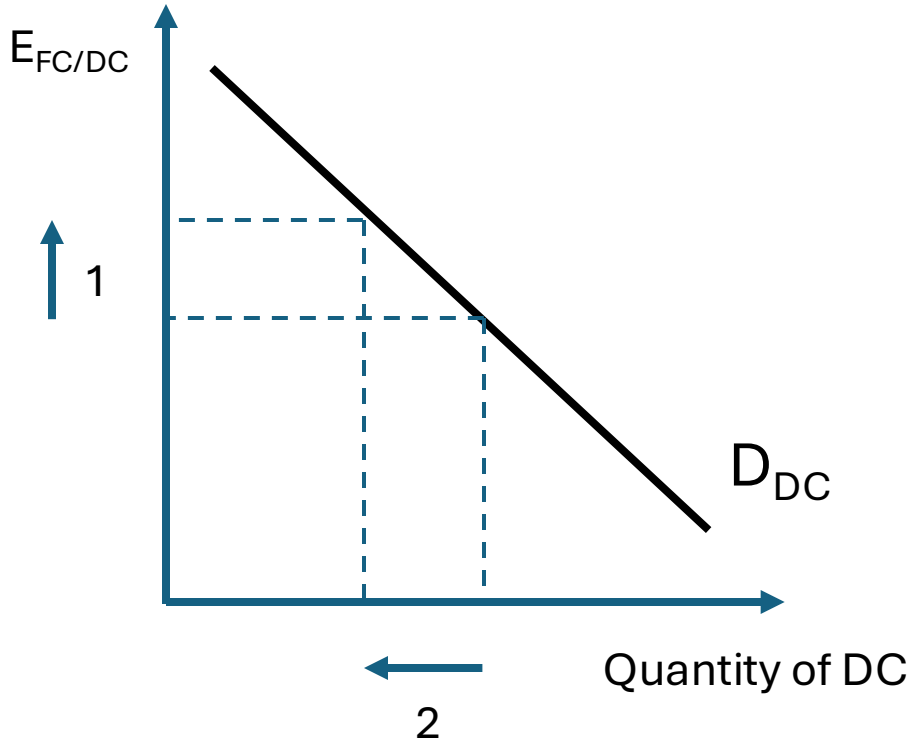
Note: When one currency appreciates, the other currency depreciates because the exchange rate is a relative price of a country's currency.

The Equilibrium Exchange Rate

- We will develop a simple model for the foreign exchange market.
- ***Demand for domestic currency, D_{DC}***, comes from ***exports*** of goods, services, and assets.
- ***Supply of domestic currency, S_{DC}***, comes from ***imports*** of goods, services, and assets.

Demand for Domestic Currency (D_{DC})

- The **demand for domestic currency** is ***downward sloping*** because, holding all else constant, when $\mathbf{E_{FC/DC}} \uparrow$ (**DC appreciates**), domestic goods, services and assets all become more expensive (relative to foreign ..) $\Rightarrow$ domestic exports $\downarrow \Rightarrow \mathbf{D_{DC}} \downarrow$.

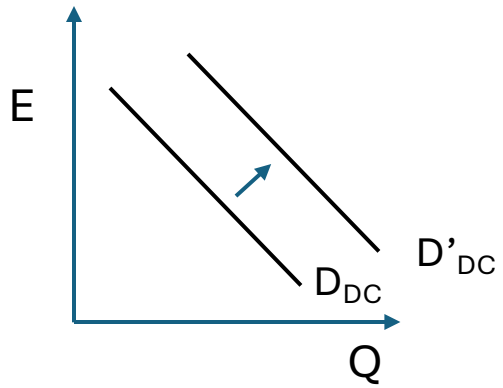


1) When $\uparrow$ $E_{FC/DC}$ the DC has appreciated, our exports are now relatively more costly, so X $\downarrow$

and,

2) This results in a drop in the quantity of DC Demanded (this moves us along the demand curve)

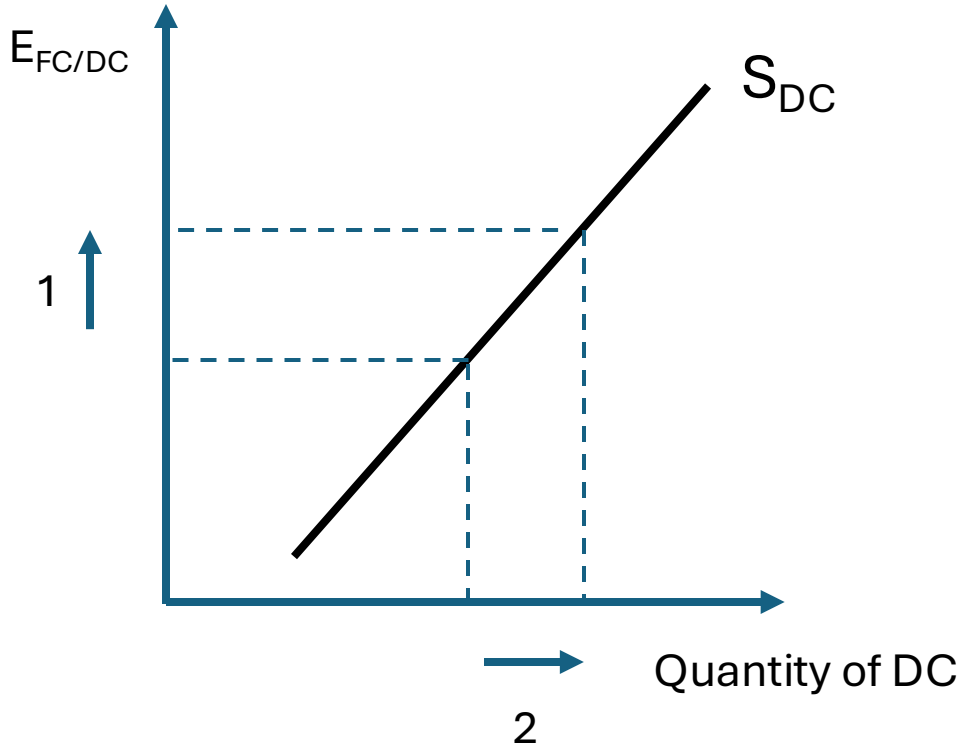
Factors that shift the demand for DC curve:



Factor	Left/Right	Reason
Foreign output, Y_F, ↑	**Right**	When Y_F ↑, foreign demand for <u>domestic</u> goods ↑ ⇒ ↑ Exports of goods & services ⇒ ↑ Demand for DC
Capital inflows ↑ such as $(i_H - i_F)$ ↑	**Right**	This implies that <u>exports</u> of assets ↑ ⇒ ↑ Demand for DC
Other factors that affect **exports** of goods, services & assets	**Right** **Increase in Demand**	Changes in consumption preference that <u>favours</u> domestic goods **or** provision of export subsidies, etc. ⇒ ↑ Exports of goods & services ⇒ ↑ Demand for DC

Supply of Domestic Currency (S_{DC})

- The **supply of domestic currency** is ***upward sloping*** because, holding all else constant, when $\mathbf{E_{FC/DC}} \uparrow$ (**DC appreciates**), domestic goods, services and assets all become more expensive (relative to foreign ..) $\Rightarrow$ domestic imports $\uparrow \Rightarrow \mathbf{S_{DC}} \uparrow$.



1) When $\uparrow E_{FC/DC}$ the DC has appreciated, Imports are now relatively cheaper, so IM $\uparrow$

and,

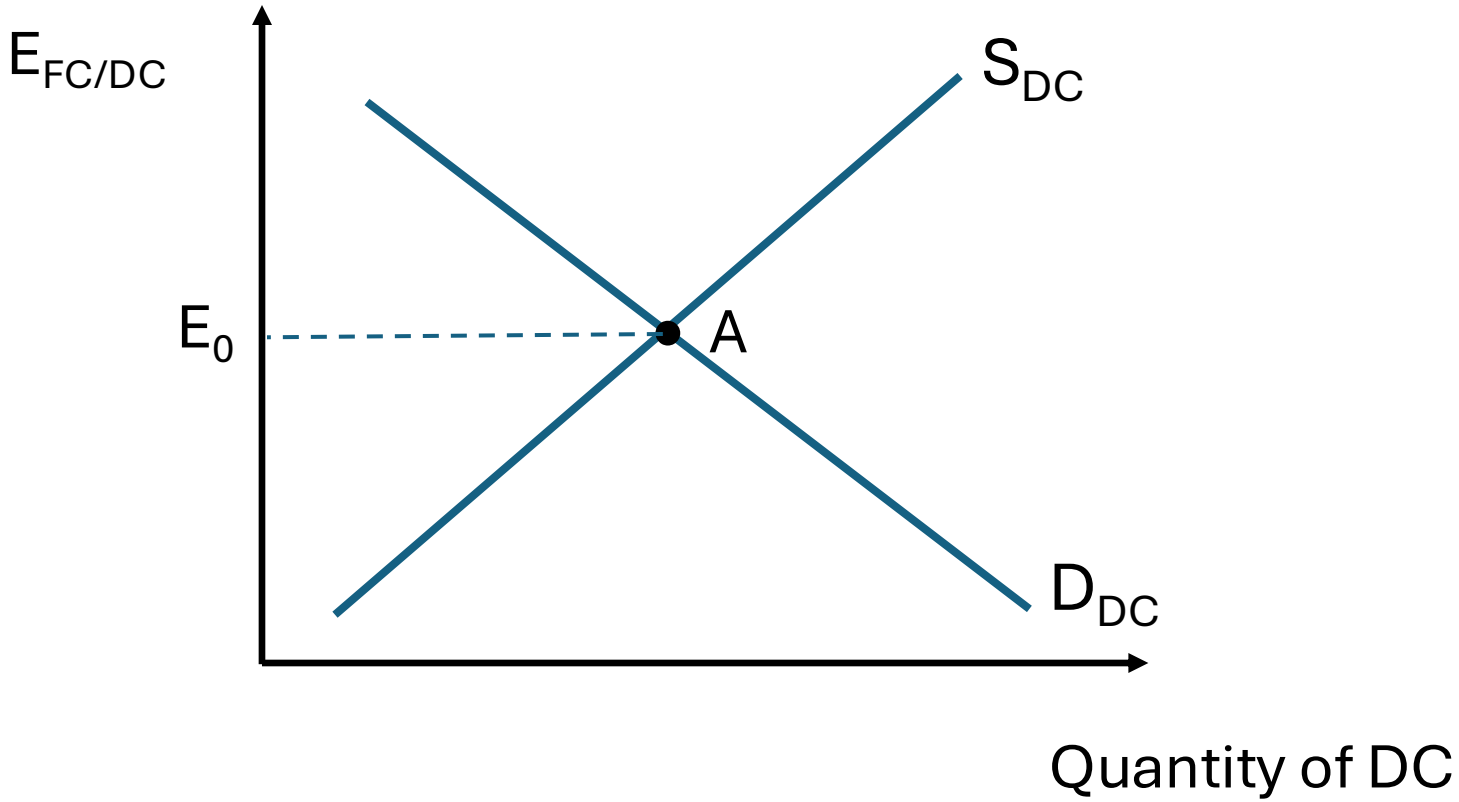
2) This results in an increase in the quantity of DC Supplied (this moves us along the supply curve)

Factors that shift the supply of DC curve:

Factor	Left/Right	Reason
Domestic output, Y_H, ↑	**Right**	When Y_H ↑, domestic demand for foreign goods ↑ ⇒ ↑ Imports of goods & services ⇒ ↑ Supply of DC
Capital outflows ↑ such as $(i_H - i_F)$ ↓	**Right**	This implies that imports of assets ↑ ⇒ ↑ Supply of DC
Other factors that affect **imports** of goods, services & assets	**Right** **Increase in Supply**	Changes in consumption preference that favours foreign goods **or** decrease in import tariffs, etc. ⇒ ↑ Imports of goods & services ⇒ ↑ Supply of DC

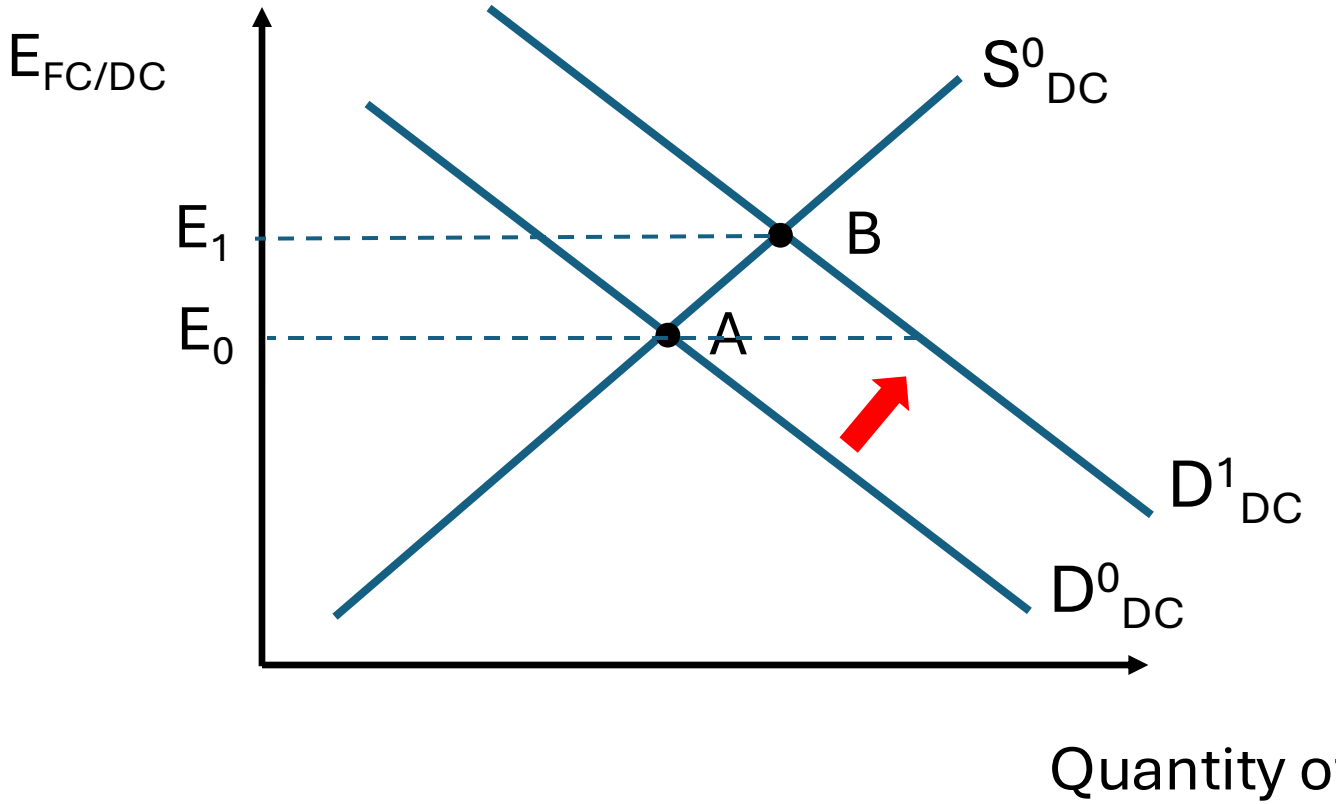
The Foreign Exchange Market

- The market for foreign exchange is in equilibrium when supply intersects demand.



Example: Suppose the domestic government provides an export subsidy.

- An export subsidy makes domestic goods become less expensive in the world market.
- Exports of goods ↑ ⇒ Demand for DC ↑ to $\mathbf{D^1_{DC}}$



- At point $\mathbf{E_0}$, there is an excess demand for DC
- Therefore, the DC **appreciates** to $\mathbf{E_1}$
- **Point B** is the **new equilibrium**

Numerical Example

Suppose the balance of payments accounts for Home can be summarized by the following equations (assume there are no other international transactions):

Exports of goods and services = $\mathbf{0.2Y_F - 30E_{FC/DC}}$

Imports of goods and services = $\mathbf{0.125Y_H + 20E_{FC/DC}}$

Purchases of foreign assets by domestic residents = $\mathbf{140 - 2000(i_H - i_F)}$

Purchases of domestic assets by foreigners = $\mathbf{225 + 1500(i_H - i_F)}$

Also, interest rate is expressed in **decimal points** (i.e., if i = 0.05, then i = 5%).

Find the equilibrium exchange rate if $\mathbf{Y_H = 6000}$, $\mathbf{Y_F = 8000}$, $\mathbf{i_H = 6\%}$ **&** $\mathbf{i_F = 4\%}$ (**Note:** the difference in interest rates may be due to a **risk premium**).

$\mathbf{D_{DC}}$ = Exports of goods, services, and assets

$= (0.2Y_F - 30E) + (225 + 1500(i_H - i_F))$

$\mathbf{= 225 + 0.2Y_F + 1500(i_H - i_F) - 30E}$

$\mathbf{S_{DC}}$ = Imports of goods, services, and assets

$= (0.125Y_H + 20E) + (140 - 2000(i_H - i_F))$

$\mathbf{= 140 + 0.125Y_H - 2000(i_H - i_F) + 20E}$

Equilibrium $\mathbf{D_{DC} = S_{DC}}$

$225 + 0.2Y_F + 1500(i_H - i_F) - 30E = 140 + 0.125Y_H - 2000(i_H - i_F) + 20E$

$225 + 0.2Y_F + 1500\mathbf{(.06 - .04)} - 30E = 140 + 0.125Y_H - 2000\mathbf{(.06 - .04)} + 20E$

$50E = 1005$ $\qquad$ $\mathbf{E^* = 20.1}$

Inflation and Real Exchange Rates

- The **exchange rate**, $E_{FC/DC}$, we have been talking about is the ***nominal exchange rate***, which is unadjusted for the international difference in aggregate price levels.
- **Real exchange rate**, $\mathbf{RE_{FC/DC}}$, is exchange rate adjusted for international differences in aggregate price levels, i.e.,

$$\mathbf{RE_{FC/DC} = E_{FC/DC} \times \frac{P_H}{P_F}}$$

- We believe that a country's net exports and current account depend on the **real exchange rate** because a country's products become cheaper only when the country's currency depreciates in **real** terms (i.e., it takes fewer units of real foreign goods to exchange for (buy) one unit of domestic real goods).

- ***In the short-run, prices are sticky;*** **changes in the <u>real</u> exchange <u>will be caused by</u> changes in the <u>nominal</u> exchange rate.**

⇒ Thus, we can argue that in the income-expenditure model (where prices are held <u>fixed</u>), exports and imports depend on the **<u>nominal</u> exchange rate**.

Export function: $\mathbf{X = X_0 - X_1 \times E_{FC/DC}}$

where $\mathbf{X_0}$ = Autonomous exports > 0 (& constant)

$\mathbf{X_1} > 0$ (& constant)

Import function: $\mathbf{IM = IM_0 + IM_1 \times Y + IM_2 \times E_{FC/DC}}$

where $\mathbf{IM_0}$ = Autonomous imports > 0 (& constant)

$$\boldsymbol{IM_1 = \frac{\Delta IM}{\Delta Y} = Marginal\ propensity\ to\ import} > 0$$

$\mathbf{IM_2} > 0$ (& constant)

The "Complete" Income-Expenditure Model

Generic form:	Numerical example:
$C = AC + MPC \times YD$	$C = 600 + 0.75YD$
$T = T_0 + t \times Y$	$T = 120 + 0.15Y$
$TR = TR_0 - tr \times Y$	$TR = 400 - 0.05Y$
$I_{Planned} = AI - di$, where $i = \bar{i}$	$I_{Planned} = 700 - 5000i$, where $i = 0.02$ (2%)
G_0	$G = 500$
$X = X_0 - X_1 \times E_{FC/DC}$	$X = 280 - 15E_{FC/DC}$, where $E_{FC/DC} = 1$
$IM = IM_0 + IM_1 \times Y + IM_2 \times E_{FC/DC}$	$IM = 250 + 0.1Y + 25E_{FC/DC}$

The $AE_{Planned}$ function in generic form:

$$AE_{Planned} = [AC + MPC\times(Y - (T_0 + t\times Y) + (TR_0 - tr\times Y))] + (AI - d\times i) + G + (X_0 - X_1\times E_{FC/DC}) - (IM_0 + IM_1\times Y + IM_2\times E_{FC/DC})$$

$$AE_{Planned} = AC + MPC\times[(1 - t - tr)Y - T_0 + TR_0] + AI - di + G + X_0 - X_1\times E_{FC/DC} - IM_0 - IM_1\times Y - IM_2\times E_{FC/DC}$$

$$AE_{Planned} = [AC + AI + G + X_0 - IM_0 + MPC\times TR_0 - MPC\times T_0 - di - (X_1 + IM_2)\times E_{FC/DC}] + [MPC\times(1 - t - tr) - IM_1]\times Y$$

$$AE_{Planned} = AE_0 + [MPC\times(1 - t - tr) - IM_1]\times Y$$

Note: $AE_0 = AC + AI + G + X_0 - IM_0 + MPC\times TR_0 - MPC\times T_0 - di - (X_1 + IM_2)\times E_{FC/DC}$

Income-expenditure model equilibrium:

$$Y = AE_{Planned}$$

$$Y = AE_0 + [MPC \times (1 - t - tr) - IM_1] \times Y$$

$$Y^* = AE_0 \times \frac{1}{1 - [MPC(1 - t - tr) - IM_1]} = AE_0 \times M$$

M = (1/)
Before **t > 0** & **tr > 0** lowered M
Now $IM_1 > 0$ also lowers M

Note: $AE_0 = AC + AI + G + X_0 - IM_0 + MPC \times TR_0 - MPC \times T_0 - di - (X_1 + IM_2) \times E_{FC/DC}$

Solve for the income-expenditure model equilibrium:

- **Step 1:** Express YD as a function of Y

  $YD = Y - T + TR = \mathbf{280 + 0.8Y}$

- **Step 2:** Express the consumption function as a function of Y.

  $C = 600 + 0.75(280 + 0.8Y) = \mathbf{810 + 0.6Y}$

- **Step 3:** Express the $AE_{Planned}$ function as a function of Y.

$\mathbf{AE_{Planned} = C + I_{Planned} + G + (X - IM)}$

$= (810 + 0.6Y) + (700 - 5000(0.02)) + 500 + (280 - 15(1)) - (250 + 0.1Y + 25(1))$

$= 810 + 0.6Y + 600 + 500 + 265 - 275 - 0.1Y = \mathbf{1900 + 0.5Y}$

- **Step 4:** Solve for the equilibrium. $\mathbf{Y = AE_{Planned}}$

$Y = 1900 + 0.5Y$

$0.5Y = 1900$ $\quad$ **Y*** $= (1900/0.5) =$ **3,800**